

intermediate ceramic layer 144 thereon. In operation, the foundation 110 is constructed on a substrate 150 upon which at least a top 130 is deposited. The substrate 150 may remain and be part of the foundation 110 as shown or the substrate 150 may be removed from the foundation 110. An OLED 160 is constructed upon the top 130 of the foundation 110, opposite the substrate 150. The cover 120 of at least a top 130 then placed over the OLED 160. The placement may be by gluing a previously constructed cover 120 on a cover substrate (not shown), or preferably by vacuum deposition. It is preferred that the OLED 160 be encased by at least a top 130 and an intermediate barrier 140 on both sides of the OLED 160 as shown in FIG. 1.

The cover may be placed over the OLED either by lamination or gluing of the cover to the foundation or preferably by vacuum deposition of the cover layers over the OLED and to the foundation. Again, the substrate 150 may remain with the foundation 110 as shown or be separated therefrom.

In a less preferred embodiment, only the foundation 110 or the cover 120 may be used with a rigid environmental barrier, for example glass, on the opposing side.

For use as a display, it is preferred that either the ceramic layer(s) 134, 144 in the foundation 110, cover 120 or both is/are substantially transparent to the light emitted by the OLED 160.

Each layer of the foundation 110 (except the substrate 150), and the cover 120 are preferably vacuum deposited. Vacuum deposition includes vacuum deposition of the monomer with monolayer spreading under vacuum, plasma deposition, flash evaporation, as well as vacuum deposition of the ceramic layer(s) with sputtering, chemical vapor deposition, evaporation, electron cyclotron resonance source-plasma enhanced vapor deposition (ECR-PECVD) and combinations thereof. It is preferred that the assembling of the foundation and/or cover is accomplished in a manner wherein the ceramic layer is not contacted by any equipment but only by enveloping polymer layers. This may be accomplished by depositing layers in a manner wherein a set of layers (foundation or cover) of polymer/ceramic/polymer is deposited prior to contacting or touching the layers with any layer handling equipment, for example rollers in a web coating system to avoid the defects that may be caused by abrasion over a roll or roller.

The substrate may be rigid or flexible, but is preferably a flexible substrate, especially when it remains with the foundation. The flexible substrate may be any flexible material including but not limited to polymer, for example polyethyleneterephthalate (PET), metal, paper, fabric and combinations thereof.

The first, second and/or intermediate polymer layer(s) may be acrylic, methacrylic, polyester or PET, polyethylene, polypropylene, and combinations thereof.

The first and/or second ceramic layer(s) may be any ceramic including but not limited to metal oxide, metal nitride, metal carbide, metal oxynitride, indium oxide (In_2O_3), tin oxide (SnO_2), indium tin oxide (ITO) and combinations thereof. It is preferred that at least one side (foundation or cover) is preferably a substantially transparent ceramic including but not limited to silica or silicon oxide (SiO_2), alumina or aluminum oxide (Al_2O_3), titania or titanium oxide (TiO_2), indium oxide (In_2O_3), tin oxide (SnO_2), indium tin oxide (ITO, $\text{In}_2\text{O}_3+\text{SnO}_2$), aluminum nitride (AlN), silicon nitride (SiN), silicon carbide (SiC), silicon oxynitride (SiON) and combinations thereof.

The layers are preferably vacuum deposited. Vacuum deposition of polymers includes liquid monomer spreading

in a vacuum, plasma deposition, flash evaporation and combinations thereof. Vacuum deposition of oxides includes chemical vapor deposition, plasma enhanced chemical vapor deposition, sputtering, electron beam evaporation, electron cyclotron resonance source-plasma enhanced chemical vapor deposition (ECR-PECVD) and combinations thereof.

Clearly the function of the foundation and cover is to prevent environmental constituents including but not limited to water, oxygen and combinations thereof from reaching the OLED. Accordingly the invention is a method for preventing water or oxygen from a source thereof reaching a device, the method having the steps of: depositing a first polymer layer between the device and the source; depositing an inorganic (ceramic) layer on the first polymer layer of the device by chemical vapor deposition, plasma enhanced chemical vapor deposition, sputtering, electron beam evaporation, electron cyclotron resonance source-plasma enhanced chemical vapor deposition (ECR-PECVD) and combinations thereof; and depositing a second polymer layer on said inorganic layer.

An electroluminescent device or OLED may have

a flexible sheet that is transparent to light of a first wavelength;

a first polymer in contact with the flexible sheet;

a first permeation barrier (ceramic or inorganic layer) in contact with the first polymer layer;

a second polymer layer in contact with the first permeation barrier;

a first electrode having a first electrode layer in contact with the flexible sheet and transparent to light of the first wavelength;

a light emitting layer of an organic material in electrical contact with the first electrode layer;

a second electrode having a second electrode layer in electrical contact with the light emitting layer, that generates light of the first wavelength when a potential difference is applied across the first and second electrodes;

a third polymer layer in contact with the second electrode layer;

a second permeation barrier of inorganic material in contact with the third polymer layer; and

a fourth polymer layer in contact with the second permeation barrier.

In this embodiment description, the combination of flexible sheet, light emitting layer, first electrode and second electrode constitute a device as recited above.

CLOSURE

While a preferred embodiment of the present invention has been shown and described, it will be apparent to those skilled in the art that many changes and modifications may be made without departing from the invention in its broader aspects. The appended claims are therefore intended to cover all such changes and modifications as fall within the true spirit and scope of the invention.

We claim:

1. A flexible environmental barrier for an organic light emitting device, comprising:

(a) a foundation having;

(i) a top of a first polymer layer, a first ceramic layer on the first polymer layer, and a second polymer layer on the first ceramic layer;

(b) an organic light emitting device constructed on the second polymer layer of the top; and